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The increasing use of fiber optics, the declining cost in telecommunications technologies, and the availability of wireless communications, cellular telephones, fax machines, and low cost computers make it economically and socially attractive to work outside the conventional workplace. This saves the employer the cost of office space, as well as many capital and operating costs, increases productivity, and provides the worker with a flexibility and control in use of his or her time. It is projected that by 2005 twenty to twenty-five percent of the work force will be involved in some form of telework.

Telework involves working beyond the traditional organizational boundaries in time and space. Teleworkers may work at home or from home, at a telecenter, or at locations other than their employers' premises. In order to study the impact of telework on organizations and individuals. We next explain factors that contribute to the telework arrangement in an input-process-output model. The input factors include people, organizational culture, objectives, and structure, information technology infrastructure, and competitions from rivals. The process factors include forms of telework, types of activity, procedures and policies, and work contract between the employer and the employee. The output factors are customers' satisfaction with services, employees' satisfaction with flexible work arrangements, family members' satisfaction with flexible work arrangements, employer's satisfaction with work performed by teleworkers, productivity, and cost. We then present guidelines for implementing a telework program. This article concludes future directions.

1 Introduction

In the midst of the oil crisis in the mid 1970's, people started looking for alternatives to oil energy or ways to conserve oil. Jack Nilles and his colleagues at the University of Southern California developed the concept of "telecommuting," involving moving work to people instead of moving people to work (1976). Toffler (1980) introduced the concept of the "telecottage" to public attention in the early eighties. He described the electronic telecottage as the home of the future, turned into a work place by microcomputers and communications technologies. Technologies such as telephones, faxes, modems, and personal computers are used to work at or from home, or a neighborhood center, instead of commuting to the central office by car or other means. Today, more and more people are involved in telecommuting or other forms of telework and companies are experimenting with various kinds of work performed outside the normal confines of space and time in business. The objectives of this article are to investigate the current status of telework, develop a framework to study the impact of telework on organizations and individuals, and present guidelines for implementing a telework program.

The concept of telework has evolved from its original meaning of electronic home work to more complex forms of distributed work environment. These include satellite centers, neighborhood centers, telecottages, and mobile work (e.g., Fritz, Higa, and Narasimhan, 1994; Di Martino and Wirth, 1990; Griffith, 1990). Various terminologies have been quoted in the literature, including telecommuting, remote office work, distance work, and teleworking (e.g., Nilles, 1976; Olson, 1983; Huws, Korte, and Robinson, 1990; Cunningham and Porter, 1992). In this article, we broadly define telework as a flexible work arrangement which covers a wide range of work activities, all of which entail working remotely from an employer, or from a traditional place of work, for a significant proportion of work time. Within this broad definition, telework may be performed on-line or off-line; it may be organized individually or collectively; it may constitute all or part of the worker's job; it may be carried out by self-employed workers or employees; it may be performed at different times than the normal nine to five work hours; it may be carried out at the employee's home, in the car, or a location other than the central office. Thus, telecommuting, telecottage, satellite center, and mobile work are subsets of telework as defined here.

We will discuss the driving forces of telework next, followed by a taxonomy of telework. A framework to study the impact of telework on organizations and individuals will then be presented, followed by guidelines for implementing a telework pilot project. This paper concludes with implications for organizations of the 21st century.

2 Driving Forces of Telework

Many reasons explain why teleworking has become more and more popular for employees as well as for employers. One of the IBM sites in Northern New Jersey implemented a mobile workforce of sales resulting a reduction of 600-people work spaces (from 800 to 200-people flexible workspaces) (WAMU, 1994). Both the

management and the mobile sales like this arrangement, the management reduced operational cost and the sales improved their productivity. AT&T announced a national telecommuting day for all their employees nation-wide in October 1994 (The Washington Post, 1994). Montgomery county government also encourages workers to telecommute (The Washington Post, 1994). Both local government and private companies promote teleworking in the Washington metropolitan area as well as other metropolitan areas such as Los Angeles. It has become a trend in the 1990's.

One of the major driving forces for telework is the technological advancement in computers and telecommunications technologies. Personal computers are more powerful, smaller, and much cheaper than a few years ago. They exist not only in many organizations but also in homes. Software programs are user-friendly and much more powerful than those of a few years ago. In addition, a range of telecommunications improvements have provided an opportunity for teleworking to grow. Amazing improvements have been made on circuit transmission capabilities and speed. From a simple open wire that could transmit only one way communication at a time, we have a multitude of wired and wireless multiplexed circuits such as coaxial cable, optical fibers, microwave satellite, and cellular radio. Not only has the speed of transmission increased drastically, but capacity and reception quality have improved also. A single fiber optic can handle 37,800 phone calls simultaneously at 10 gigabits per second. The establishment of nationwide broadband fiber-optic networks will be critical to the next generation of teleworking (Weiss, 1992).

Telecommunication services have also improved. Integrated Services Digital Network allows transmission of data, voice, video, and image on the same medium. Asynchronous Transfer Mode (ATM) permits faster transmission of multimedia applications between different networks. The increasing use of the Internet has also facilitated communications among industries, research institutes, and government agencies. Electronic communication via modems and phone lines or cellular allows workers to communicate with corporate computers and colleagues. Fax machines are utilized to send documents. Videoconferencing technology permits electronic meetings and reduces the necessity to travel. Information superhighway links networks world-wide and access to information becomes just a click away.

Another driving force comes from the organization itself, striving for better services for their customers, improved productivity by their workers, and improved business processes to cut costs. As Di Martino and Wirth (1990, p. 529) state "the positive consequences of the decentralization and increased worker autonomy and mobility brought about by telework can be seen in higher levels of productivity, improved working-time arrangements and new employment opportunities for various categories of workers, potentially without geographical limits." The push to reengineer business processes to provide better customer services, the need to retain skilled workers and to allow greater autonomy, all increase the need for teleworking. Telework increases productivity, provides enterprise flexibility, facilitates the recruitment and retention of skilled staff, provides jobs for disabled, and increases incentives for overtime and shiftwork (Di Martino and Wirth, 1990; Bellinger and La Van, 1992; Monson, 1993).

There are also economical reasons that push both management and employees to consider teleworking. Telework reduces commuting time. Thus, teleworkers save on gas, parking, automobile repair, and transit fares by not driving or commuting to work every day. They also save on restaurant lunches and buy fewer business suits. Additionally, telework offers flexible scheduling, allowing time optimization. Managers report that the quantity and quality of work done by teleworkers goes up by an average of 20% (Nilles, 1991). For employers, teleworking increases the off-peak use of computer equipment. It also reduces the cost of office space, training replacement and relocation (Di Martino and Wirth, 1990). By offering teleworking, companies can recruit skilled workers and reduce turnover rates.

Telework offers flexible work arrangements that reduces commuting time and at the same time reduces commuting stress (e.g., Crossan and Burton, 1993). This translates into higher productivity and less interpersonal confrontation. Research results also indicate that telework enhances family life. Teleworkers may have more time to spend with their families (Huws, Korte, and Robinson, 1990; Huws, 1991). Government regulations such as the Clean Air Act, which took effect in November, 1992, the Family and Medical Leave Act signed by President Clinton (Ross, 1993), and the Telecommuting Act that is still evolving give organizations incentives to provide a flexible work arrangement for their workers to help reduce pollution and save energy. Thus, it provides a cleaner and better environment for our next generation.

3 A Taxonomy of Telework

We categorize telework into three forms of work arrangement based on the place where work is performed. They are work-at-home or work-from-home; work at a telecenter; and mobile work.

Work-at-home is primarily home-based work for those who are self-employed or contractors who perform all work at home. This form of telework requires minimum technologies such as personal computers for word processing, data entry, or data analysis, a fax machine to send documents to clients, a telephone to contact clients, a modem and communications software to gain access to electronic mail and/or wide area networks such as the Internet.

Work-from-home on the other hand differs from work-at-home in the way the work is performed. Although the worker is physically at home, the work is performed through a communication link with the main computers at the organization site. Thus, it relies heavily on telecommunications technologies to facilitate the sending and receiving data from the main computer to the computer at home. This form of telework requires telecommunications technologies such as a dedicated phone line or a data line for data transmission, a modem and communications software, and a personal computer or a workstation. A fax machine and videoconferencing facility may be necessary depending on needs. A videoconferencing facility allows two-way video transmission so that the worker may join a conference through the video transmission with colleagues at other sites. It delivers a new team-working medium for geographically dispersed organizations and workforce (Lyons, Cochrane, and Fisher, 1993). Some of the major benefits of this work arrangement include flexible work hours, better family life, and more autonomy. However, one of the primary complaints about this work arrangement is that workers felt isolated. There is minimum social interactions among workers. In addition, it is difficult to separate work and home life.

Work at a telecenter (i.e., satellite center, neighborhood work center) is another form of telework that is very popular, particularly in Europe. A telecenter is an establishment near the workforce on behalf of one or more employers. Employees report to these centers everyday and dial in to their respective jobs. Because telecenters offer more structure than a work at/from home situation, companies have found them to be more realistic and useful (Coates, 1993). These telecenters are equipped with necessary office equipment such as phones, faxes, copiers, computers, and even secretaries. They allow social interactions among employees and at the same time provide a structured work environment with less commuting and less commuting stress.

Mobile work is a new form of work arrangement particularly suitable for service-oriented workers. This form of telework is the most dynamic one where work may be performed in a car on the road, at a coffee shop, a bus stop, a train station, on the airplane, or at a client site. It requires state-of-the-art telecommunications technologies such as cellular phones, wireless communication linking to corporate computers, wireless fax, and notebook computers. This work arrangement provides ultimate customer services and requires minimum office space. The IBM site at Northern New Jersey reduces office space by enabling customer representatives to spend more time on the road (WAMU, 1994). The usual office space becomes cubicles equipped with a phone and a fax machine to be randomly assigned to the mobile workforce, who report to the office once a week.

4 A Framework to Study the Impact of Telework

In order to investigate the impact of telework on organizations as well as individuals, we develop a framework to do so. We have chosen a system's approach to view telework as any type of information technology innovation, in which there are input factors, such as people involved in the process, the organizational cultural, the organizational objectives, the organizational structure, competitions from rivals, and the information technology infrastructure, that limit the context and setting for the kind of telework to be implemented; there are process factors, such as forms of telework, types of activities involved, procedures and policies established for telework, and specific work contract required, that dictate how and what type of telework to be implemented; and there are output factors, such as customers' satisfaction with services, employees' satisfaction with telework, family's satisfaction with telework, employer's satisfaction with work performed by teleworker, productivity, and cost, that are output measurements to assess the impact of telework on organizations, individuals, and their families. These factors are summarized in Table 1 and are discussed below.

Input Factors	Process Factors	Output Factors
People	Forms of Telework	Customers' Satisfaction/w Services
Organizational Culture	Types of Activity	Employees' Satisfaction/w Telework
Organizational Objectives	Procedures & Policies	Family's Satisfaction/w Telework
Organizational Structure	Work Contract	Employer's Satisfaction/w Work Performed by Teleworker
Competition from Rivals		Productivity
IT Infrastructure		Cost

Table 1. A Framework to Study the Impact of Telework

4.1 Input Factors

People - Permanent employees, temporary employees, part-time employees, and self-employed contractors. They exhibit different work habits, personal traits (e.g., morning person, night person, self-starter, self-motivated, etc.), have different family arrangements (e.g., children and or elder dependent, single parent, etc.) and life styles.

Organizational Culture/Objectives/Structure - These are the fundamental differences between organizations. The organizational culture and its objectives and goals affect management philosophy and implementation strategies (Richter and Meshulam, 1993). They also have an impact on how the job is distributed, what technologies if any are used, how meetings are conducted, and how performance is evaluated. The organizational structure varies from centralized to fully distributed management. Each structure may affect how telework is implemented.

Competition from Rivals - Other organizations in the same industry or close proximity provide a flexible work arrangement and fully utilize information technologies to gain competitive advantages. These organizations may compete with the same pool of skilled knowledge workers as well as customers.

Information Technology Infrastructure - This includes computers and communications technologies that are present in the organization, the utilization of technologies to facilitate work, support from top management to adopt new technologies, technical and capable staff, training programs for users, and acceptance from workers (e.g., Olson and Primps, 1984).

4.2 Process Factors

Forms of Telework - Including work performed in a traditional office environment, work-at-home, work-from-home, work at a telecenter, and mobile work. Each form of telework requires certain computer and communications technologies to support activities to perform a task. Each form of telework may have vary impact on organizations as well as individual, thus outcome measures such as satisfaction with a particular work arrangement will be different.

Types of Activity - Activities which occur while performing a task. Such activities include communications, coordinations, decision making, information retrieval, information sharing, and keeping in touch with management and/or colleagues. These activities are independent to the forms of telework and positions that an employee may hold in an organization. Particular computers or communications technologies may facilitate a specific type of activity better than the other.

Procedures and Policies - Administrative procedures and policies for reporting to the management regarding assignments, sickness, injuries during work, reimbursement, etc. These procedures and policies may reflect changes in organization culture, shifts in management style, and modifications in organization structure.

Work Contract - Contract between each employee and employer must be modified to reflect the changes in work arrangement. These may include report procedures, performance evaluation, worker's compensation, benefits, promotion, training and additional incentives.

4.3 Output Factors

Customers' Satisfaction with Services - measures customer services provided by the organizations with or without the flexible work arrangement and the type of telework that is implemented. Data may be collected from sampling customers on a Likert scale using a survey questionnaire.

Employees' Satisfaction with Telework - measures employees' attitude toward the flexible work arrangement, particularly toward telework. Data may be collected on a long term base assessing employee's personal satisfaction with this arrangement (Bailyn, 1989).

Family Members' Satisfaction with Telework - measures satisfaction of family members of those who telework at or from home. Data may be collected by using structured questionnaires and interviews.

Employer's Satisfaction with Work Performed by Teleworkers - measures employer's satisfaction with the work performed by each individual teleworker (Olson, 1989). Data may be collected by interviews, observations, and structured questionnaires.

Productivity - measures productivity level of individual worker in different settings. Historic performance data may be used to compare with productivity with telework. It may be quantified by using a self-reported figure or by collecting objective measurements such as number of tasks performed during a specific period of time, number of records

entered, number of customers contacted, or number of program modules developed.

Cost - measures operating cost, retraining cost, cost of office space, cost of relocation, and cost of personnel benefits, hardware/software, and other required telecommunications technologies.

5 Guidelines for Implementing a Telework Program

Ross (1993, p. 54) discussed five commandments of telecommuting. They are: (1) set clear objectives including work hours, measures of success; (2) select jobs performed easily at a remote site; (3) choose top-performing employees; (4) use excess or obsolete equipment or establish employee purchase plan; and (5) create a telecommuting contract that covers objectives, work hours, and corporate liability. Gray, Hodson, and Gordon (1993, pp. 31-42) also discussed 14 steps to setup a pilot. These include: (1) identify business objectives; (2) choose the route: easy or hard; (3) find a champion; (4) plan the pilot; (5) decide the success factors; (6) involve the people; (7) identify jobs; (8) decide technical requirements; (9) decide type of teleworking; (10) study "at work" processes and interactions; (11) design the teleworking support team; (12) install the system and go; (13) monitor the pilot; and (14) consider the roll-out.

Based on the described framework and the literature, we have developed a more complete set of guidelines for organizations to implement a telework program than Ross' and Gray, Hodson, and Gordon's suggestions. There are four areas of requirements that organizations need to be concerned with. They are organizational, technological, legal, and managerial requirements. We discuss these requirements below and also indicate the corresponding input, process, or output factor along with each requirement.

5.1 Organizational Requirements

Define organizational objectives (input factor) - These may include reduced costs, improved productivity, increased flexibility of work arrangement, improved customer services, retention of skilled workers, and increased employee satisfaction.

Identify a champion (input factor) - As in every innovation it is vital to have a champion (Nilles, 1991). A champion is someone who has a vision and believes in work force mobility and is committed to implementing a pilot project. This champion must receive support from both top and middle management as well as teleworkers.

Form a telework task force (input factor)- This ad hoc committee provides necessary support to the champion and collects forces from all departments of the organization to facilitate the development of a strong telework program.

Define selection criteria (input factor) - Criteria to qualify employees to be teleworkers should be identified. These may include work habits, previous performance, familiarity with company policies, family arrangements, or attitude toward telework.

Identify potential teleworkers (input factor) - Employees who are qualified and interested in the pilot project should be identified and be included in the planning process.

Identify jobs and tasks (process factor) - Types of jobs and tasks appropriate for teleworking are identified and clearly defined as relating to performance evaluation.

Assess cost and benefits (output factor) - Potential costs include purchasing new equipment and software, installing networks and other communication lines, training and maintenance, and legal advises. Projected benefits are identified and compared with costs estimated. A cost/benefit analysis report is useful to management to determine how to implement a telework project.

5.2 Technological Requirements

Define technical specifications for various forms of telework (process factor) - It is advisable to define technical specifications for all forms of telework that the company is considering adopting. This helps in assessing costs.

Identify required computers and communications technologies (process factor) - Minimum required technologies associated with each form of telework and different types of activities are to be identified. A matrix may be useful to lay out requirements as well as plans for installations.

Identify excess and/or obsolete hardware (process factor) - Know what the company already have and may be utilized for the telework project. Also survey what potential teleworkers already have and need to acquire to setup a remote office.

Establish a test center for computer and communications hardware and software (process factor) - A test center is helpful to evaluate network performance and the access speed to the corporate

computer. In addition, it may be used as a training facility for teleworkers to learn new technologies to perform their work outside the office environment.

Train teleworkers to use required computer and communications equipment (process factor) - Provide necessary training to teleworkers about the hardware, software, communications, and administrative reporting procedures.

5.3 Legal Requirements

Modify employment contract to reflect telework arrangement (process factor) - Specify benefits, procedures, and workers compensation in the employment contract to reflect telework arrangement. It is a legal document and both parties are bonded with the content of the employment contract.

Identify personal and corporate liability (process factor) - This may be part of the employment contract or a separate document specifying personal and corporate liability outside of the corporate premise during work. It includes not only personal safety but also physical and intellectual property security.

5.4 Managerial Requirements

Establish work rules (process factor) - Include hours of work and hours of accessibility (Nilles, 1991).

Identify supervising procedures (process factor) - Specific login procedures such as in the beginning and at the end of a work day, frequent visits to work-at-home teleworkers, or keeping a log are some ways of supervising teleworkers. Feedback mechanisms should be defined as well.

Identify coordination process (process factor) - Phone calls, fax memos, or electronic mails are ways to coordinate activities among co-workers or co-teleworkers.

Identify ways to motivate a dispersed workforce (process factor) - Surprise parties, bonuses, additional leave, shorter work hours may be some ways to motivate teleworkers.

Identify communication mode and frequency (process factor) - Phone calls, electronic mails, faxes are some ways of communicating with management and colleagues.

Establish administrative procedures (process factor) - Procedures for emergency, sickness and accidents report, expenses reimbursement, performance evaluation, training, and career development are specified for teleworkers.

Establish security mechanisms (process factor) - Security measures should be identified to protect corporate properties including business opportunities, computer and communications technologies, corporate documents, and intellectual properties. These mechanisms may include passwords, photo Ids, key locks, digital signatures, and authentication.

6 Conclusion

Telework provides a flexible work arrangement in which both employers and employees can benefit. It combines computers and communications technologies to allow the relaxation of the time and place constraints for the teleworkers. Telework requires a management system that supervises the output (results of work) rather than the input (ways of working, working time, place, etc.) concentrating on decentralization and involvement rather than centralization and control (Di Martino and Wirth, 1990). Organizations planning a telework program need to be aware of technological advancements and to select technologies that will be most effective in meeting the organizational objectives. Management must be prepared for resistance to the required organizational culture changes. Participation from employees in its planning stage is a key to success. Additionally, managerial styles must shift from external control based on formal procedures and formal measures of output to internal control. Giving teleworkers all the tools they need to check their own work is also very important. Successful teleworkers combine eight qualities: they must be communicative, trustworthy, willing, experienced, self-confident, self-disciplined, well-organized, and team players (Arthur, 1992).

In this article, we reviewed driving forces for telework, discussed a taxonomy of telework, presented a framework to study the impact of telework, and presented guidelines for implementing a telework program. Empirical studies to evaluate the impact of telework on organizations and individuals are worth pursuing. Implementation strategies for various forms of telework deserve further attention.

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